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FILE 'CA' ENTERED AT 17:13:05 ON 22 AUG 2003

L1 16062 S (STABILIZ? OR STABILIS? OR THIOL? OR DITHIOL? OR ALKANETHIOL OR AMIN?) (5A) (PARTICLE OR COLLOID? OR NANOPART? OR CLUSTER OR NANOCRYS? OR NANOCLUST?)
L2 9804 S L1 NOT PY>1997
L3 2060 S L2 AND (METAL OR GOLD OR AU OR SILVER OR AG OR COPPER OR CU)
L4 200 S L3 AND (NANO? OR SELF ASSEMB?)
L5 1860 S L3 NOT L4
L6 51 S L5 AND ELECTRODE
L7 251 S L4, L6
L8 219 S L7 NOT (ORGANOSOL OR CUBO? OR GELATIN OR ELECTROPHOR? OR CITRATE)
L9 32 S L7 NOT L8
L10 8 S L9 AND (AMINOSILANE OR REDOX OR HIGHLY ORDERED OR INTERDIG? OR FUNCTIONALIZED)
L11 165 S L8 NOT (PASSIVAT? OR RADIOLY? OR SURFACT? OR ROUGH? OR MILLING OR SOL-GEL)
L12 54 S L8 NOT L11
L13 14 S L12 AND (SUPERLAT? OR SERS OR THIOL OR ALKANETHIOL)
L14 121 S L11 NOT (CADMIUM OR STAIR? OR 100 OR LYSINE OR ZEROVAL? OR OSMIUM OR SILICA)
L15 44 S L11 NOT L14
L16 6 S L15 AND (CORE SHELL OR LIGAND STABIL? OR 1 10)
L17 82 S L14 NOT (CATALY? OR CERAMIC OR CHOLEST? OR FUEL OR ELECTROFORM?)
L18 39 S L14 NOT L17
L19 1 S L18 AND HETERO
L20 65 S L17 NOT (GRAIN OR ANNEAL? OR COAL? OR HYDROSOL OR FERRITE OR AGI OR TLC OR ALUMINA)
L21 17 S L17 NOT L20
L22 2 S L21 AND THIOL/TI
L23 37 S L3 AND SPRAY?
L24 96 S L10, L13, L16, L19-20, L22

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L24 ANSWER 14 OF 96 CA COPYRIGHT 2003 ACS on STN

AN 127:128632 CA

TI Light-directed assembly of nanoparticles

AU Vossmeye, Tobias; DeIonno, Erica; Heath, James R.

CS Mol. Design. Inst., Lawrence Berkeley Lab. Dep. Chem. Biochem., Univ. California, Los Angeles, CA, 90095-1569, USA

SO Angewandte Chemie, International Edition in English (1997), 36(10), 1080-1083

AB Cleaned glass or silicon slides were treated with 3-aminopropyltrimethoxysilane and the surface amino groups were reacted with nitroveratryloxycarbonylglycine (NVOC) to produce photosensitive surface. Imagewise irradn. with $\lambda > 340$ nm through a microchip mask yielded a pattern of free- and protected amino groups. The patterned substrate was kept overnight in the soln. contg. 12-aminododecane-capped Au particles to bind Au nanocrystals to the surface-bound amino-groups. To amplify particle binding the surface-bound Au particles were treated with 1,8-octanedithiol to yield free, surface-bound thiol groups on the areas where Au particles were attached to the surface. Following the dithiol treatment the slides were dipped again in the gold soln. to bind more Au nanocrystals on the previously bound particles. This dithiol amplification was repeated several times to enhance the micropattern contrast until it was readily visible with

the naked eye or via optical microscope.

- L24 ANSWER 20 OF 96 CA COPYRIGHT 2003 ACS on STN
AN 127:26748 CA
TI Synthesis of nanoscale arrays of coupled metal dots
AU Osifchin, Richard G.; Andres, Ronald P.; Henderson, Jason I.; Kubiak, Clifford P.; Dominey, Raymond N.
CS School of Chemical Engineering, Purdue University, West Lafayette, IN, 47907, USA
SO Nanotechnology (1996), 7(4), 412-416
AB The authors report on a synthetic strategy for fabrication of close-packed planar arrays of nanometer diam. metal clusters. The clusters are single fcc. crystals of Au, each encapsulated by a monolayer of alkyl thiol mols. They are electronically coupled by aryl dithiol mols. This structure, which is of interest for developing nanoscale electronics, is created using mol. self-assembly methods. It should prove possible to tune the cond. of such arrays from the metallic limit to the insulating limit by controlling the size of the Au clusters and the strength of the electronic coupling between them.
- L24 ANSWER 39 OF 96 CA COPYRIGHT 2003 ACS on STN
AN 125:291641 CA
TI Self-assembly of a two-dimensional superlattice of molecularly linked metal clusters
AU Andres, Ronald P.; Bielefeld, Jeffery D.; Henderson, Jason I.; Janes, David B.; Kolagunta, Venkat R.; Kubiak, Clifford P.; Mahoney, William J.; Osifchin, Richard G.
CS School Chemical Engineering, Purdue Univ., West Lafayette, IN, 47907, USA
SO Science (Washington, D. C.) (1996), 273(5282), 1690-1693
AB Close-packed planar arrays of nanometer-diam. gold clusters that are covalently linked to each other by rigid, double-ended org. mols. were self-assembled. Au nanocrystals, each encapsulated by a monolayer of alkyl thiol mols., were cast from a colloidal soln. onto a flat substrate to form a close-packed cluster monolayer. Org. interconnects (aryl dithiols or aryl diisonitriles) displaced the alkyl thiol mols. and covalently linked adjacent clusters in the monolayer to form a two-dimensional superlattice of metal quantum dots coupled by uniform tunnel junctions. Elec. conductance through such a superlattice of 3.7-nm-diam. Au clusters, deposited on a SiO₂ substrate in the gap between two Au contacts and linked by an aryl di-isocyanophenylethynyl)-2-ethylbenene], exhibited nonlinear Coulomb charging behavior.
- L24 ANSWER 47 OF 96 CA COPYRIGHT 2003 ACS on STN **BEST AVAILABLE COPY**
AN 125:100580 CA
TI Nanocrystal gold molecules
AU Whetten, R. L.; Khouri, J. T.; Alvarez, M. M.; Murthy, S.; Vezmar, I.; Wang, Z. L.; Cleveland, C.; Luedtke, W. D.; Landman, Uzi
CS School Physics, Georgia Institute Technology, Atlanta, GA, 30332-0430, USA
SO NATO ASI Series, Series E: Applied Sciences (1996), 316 (Chemical Physics of Fullerenes 10 (and 5) Years Later), 475-490
AB A discrete family of Au nanocrystals passivated by self-assembled monolayers was processed and isolated as distinct, highly purified mol. materials of high intrinsic stability. While each member of this family has a definite mass and structure, they share common features: fcc. Au lattices, morphologies of a dominant truncated-octahedral motif, and a strongly bound and compact protective layer conferring remarkable materials properties.
- L24 ANSWER 56 OF 96 CA COPYRIGHT 2003 ACS on STN

AN 124:271424 CA
TI Two-Dimensional Arrays of Colloidal Gold Particles: A Flexible Approach to Macroscopic Metal Surfaces
AU Grabar, Katherine C.; Allison, Keith J.; Baker, Bonnie E.; Bright, Robin M.; Brown, Kenneth R.; Freeman, R. Griffith; Fox, Audrey P.; Keating, Christine D.; Musick, Michael D.; Natan, Michael J.
CS Department of Chemistry, Pennsylvania State University, University Park, PA, 16802-6300, USA
SO Langmuir (1996), 12(10), 2353-61
AB Covalent attachment of nanometer-scale colloidal Au particles to organosilane-coated substrates is a flexible and general approach to formation of macroscopic Au surfaces that have well-defined nanostructure. Variations in substrate (glass, metal, Al₂O₃), geometry (planar, cylindrical), functional group (-SH, -P(C₆H₅)₂, -NH₂, -CN), and particle diam. (2.5-120 nm) demonstrate that each component of these assemblies can be changed without adverse consequences. Information about particle coverage and interparticle spacing was obtained by using AFM, field emission SEM, and quartz crystal gravimetry. Bulk surface properties were probed with UV-visible spectroscopy, cyclic voltammetry, and surface enhanced Raman scattering. Successful application of the latter 2 techniques that these substrates may have value for Raman and electrochem. measurements. This assembly method is compared with previous methods for controlling the nanoscale roughness of metal surfaces, and its potential applicability to the assembly of other colloidal materials is discussed.

L24 ANSWER 58 OF 96 CA COPYRIGHT 2003 ACS on STN

AN 124:186411 CA
TI Structure and Chain Dynamics of Alkanethiol-Capped Gold Colloids
AU Badia, A.; Gao, W.; Singh, S.; Demers, L.; Cuccia, L.; Reven, L.
CS Department of Chemistry, McGill University, Montreal, QC, H3A 2K6, Can.
SO Langmuir (1996), 12(5), 1262-9
AB The structure and dynamical behavior of short and long chain alkanethiols, CH₃(CH₂)₇SH and CH₃(CH)₁₇SH, and of a hydroxyalkanethiol, HO(CH₂)₁₆SH, adsorbed onto gold nanoparticles were studied by variable temp. solid-state ¹³C NMR spectroscopy. In both the soln. and solid state, the resonances of the first three carbons next to the sulfur headgroup disappear upon binding to the gold, indicating a strong interaction with the surface. A ¹³C-enriched sample, CH₃(CH₂)₁₂*CH₂SH/gold, displays a broad resonance centered at 42 ppm for the carbon next to the sulfur headgroup. Whereas the solid-state ¹³C shifts of CH₃(CH₂)₇SH/gold are essentially the same as in soln., the methylene carbons of CH₃(CH₂)₁₇SH and HO(CH₂)₁₆SH/gold shift downfield by 4.5 ppm in the solid state, indicating that the chains crystallize into an extended all-trans conformation. The high conformational order, along with reduced methylene proton line widths in the CH₃(CH)₁₇SH/gold sample, indicates that the chains are undergoing large-amplitude motions about their long axes. Mol. mobility increases toward the unbound ends which have a higher population of gauche conformers. Relaxation measurements show the coexistence of motionally restricted all-trans chains and a smaller population of liq.-like conformationally disordered chains in CH₃(CH₂)₁₇SH/gold at room temp. The two types of chains are proposed to arise from close packing of the gold colloidal spheres, resulting in interstitial spaces and regions where chains of neighboring colloids can interdigitate to produce ordered domains. Phase transitions of the thiol-capped gold nanocrystals, which are detected by differential scanning calorimetry, are shown to involve a reversible disordering of the alkyl chains.

L24 ANSWER 59 OF 96 CA COPYRIGHT 2003 ACS on STN

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AN 124:161319 CA
TI Single electron tunneling in molecular **nanostructures** of single-crystal **gold clusters** attached by **dithiols** to Au(111): Direct I(V) measurements of individual surface attached **gold** clusters by STM
AU Osifchin, R. G.; Mahoney, W.; Andres, R. P.; Dorogi, M.; Reifenberger, R. G.; Feng, S.; Henderson, J. I.; Bein, T.; Kubiak, Clifford P.
CS Department Chemistry, Purdue University, West Lafayette, IN, 47907-1393, USA
SO Polymeric Materials Science and Engineering (1995), 73, 208-9
AB The authors report the chem. attachment of large (> 200 atom) **gold clusters** by **dithiols** to **gold** surfaces, and the use of this mol. **nanostructure** to directly measure current-voltage responses by STM of individual **gold** clusters linked by mols. to surfaces. Dense, highly oriented monolayers of alk. thiols such as 1-octadecanethiol are formed on **gold** by spontaneous adsorption from ethanol solns. The authors show that a SAM (**self-assembled monolayer**) of a particular thiol can be completely displaced by exposure to a soln. contg. a different thiol. Results of reflection absorption IR spectroscopy, surface-enhanced Raman spectroscopy, ellipsometry, and measurement of advancing contact angle demonstrate that, in the case of a double-ended thiols, SAMs can be formed in which only one end of the dithiol attaches to the **gold** surface. Finally, the authors show that SAMs of dithiols can be used as chem. "sticky" surfaces for subsequent attachment of cryst. nanometer-scale **gold** clusters.

L24 ANSWER 71 OF 96 CA COPYRIGHT 2003 ACS on STN

AN 123:128557 CA
TI A fascinating new field in **colloid** science: small **ligand-stabilized metal clusters** and their possible application in microelectronics. Part II. Future directions
AU Schoen, G.; Simon, U.
CS Institut Anorganische Chemie, Universitaet Essen, Essen, 45127, Germany
SO Colloid and Polymer Science (1995), 273(3), 202-18
AB A review with 55 refs. Small **metal** clusters, like $\text{Au}_{55}(\text{PPh}_3)_{12}\text{Cl}_{16}$, which fall in the size regime of 1-2 nm are colloidal **nanoparticles** with quantum properties in the transitional range between **metals** and semiconductors. These chem. tailored quantum dots show by the Quantum Size Effect (QSE) a level splitting between 20 and 100 meV, increasing from small particle sizes to the mol. state. The org. ligand shell surrounding the cluster acts like a dielec. "spacer" generating capacitances between neighboring clusters down to 10^{-18} F. Therefore, charging effects superposed by level spacing effects can be obsd. The **ligand-stabilized colloidal** quantum dots in condensed state can be described as a novel kind of artificial solid with extremely narrow mini or hopping bands depending on the chem. adjustable thickness of the ligand shell and its properties. Since its discovery, the Single Electron Tunneling (SET) effect has been recognized to be the fundamental concept for ultimate miniaturization in microelectronics. The controlled transport of charge carriers in arrangements of **ligand-stabilized clusters** has been obsd. already at room temp. through Impedance Spectroscopy (IS) and Scanning Tunneling Spectroscopy (STS). This reveals future directions with new concepts for the realization of simple devices for Single Electron Logic (SEL). Part II presents models and connections between microscopic and macroscopic level, regardless of whether there already exist suitable **nanoscale metal** cluster compds., and is aimed at the ultimate properties for a possible application in microelectronics.

L24 ANSWER 74 OF 96 CA COPYRIGHT 2003 ACS on STN

AN 123:73202 CA
TI Chemical synthesis of large **metal** clusters and their properties
AU Schmid, G.

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CS Inst. Inorg. Chem., Univ. Essen, Essen, 45117, Germany
SO Nanostructured Materials (1995), 6(1-4), 15-24
AB A review, with 16 refs. The synthesis of ligand-**stabilized metal colloids** and **clusters** in the size range of 1-30 nm succeeds by redn. of corresponding **metal salts** in the presence of appropriate ligand mols. Due to the protection of the surface atoms by the chem. bonded ligands these materials can be isolated and handled as a solid materials. The main interest in these materials involves the boundary of the metallic state. Susceptibility measurements indicate that 15-nm Pd colloids already show significant deviations from the bulk behavior. However, Moessbauer and NMR spectroscopic studies as well as cond. measurements prove that even 1-3-nm clusters still possess freely mobile electrons. Impedance and scanning tunneling spectroscopy identify 1.4-nm two-shell clusters as species with beginning semiconducting properties. Consequently, such clusters can act as individually working quantum dots and so may play a decisive role in the future of **nanoelectronics**.

L24 ANSWER 75 OF 96 CA COPYRIGHT 2003 ACS on STN
AN 123:41388 CA

TI A fascinating new field in **colloid** science: small **ligand-stabilized metal clusters** and possible application in microelectronics. Part I. State of the art

AU Schoen, G.; Simon, U.

CS Institut Anorganische Chemie, Universitaet Essen, Essen, 45127, Germany
SO Colloid and Polymer Science (1995), 273(2), 101-17

AB A review with 84 refs. Small **metal** clusters, like Au55 (PPh₃)₁₂Cl₆, which fall in the size regime of 1-2 nm are **colloidal nanoparticles** with quantum properties in the transitional range between **metals** and semiconductors. These chem. tailored quantum dots show regarding the Quantum Size Effect (QSE) a level splitting between 20 and 100 meV, increasing from small particle sizes to the mol. state. The org. ligand shell surrounding the cluster acts like a dielec. "spacer" generating capacitances between neighboring clusters down to 10-18 F. Therefore, charging effects superposed by level spacing effects can be obsd. The **ligand-stabilized colloidal** quantum dots in condensed state can be described as a novel kind of artificial solid with extremely narrow mini or hopping bands depending on the chem. adjustable thickness of the ligand shell and its properties. Since its discovery, the Single Electron Tunneling (SET) effect has been recognized to be the fundamental concept for ultimate miniaturization in microelectronics. The controlled transport of charge carriers in arrangements of **ligand-stabilized clusters** has been obsd. already at room temp. through Impedance Spectroscopy (IS) and Scanning Tunneling Spectroscopy (STS). This reveals future directions with new concepts for the realization of simple devices for Single Electron Logic (SEL). Part I presents the fundamental aspects of small **ligand-stabilized metal clusters** as well as their phys. properties, emphasizing their electronic and optical properties with respect to dielec. response at ambient temps.

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